# Fish Acoustics Science Review

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## LONG-TERM GOALS

To understand and exploit acoustic reverberation by and transmission through fish and related acoustic signal processing. The focus will be on swimbladder-bearing fish with resonance frequencies in the 100's of Hz to low kHz.

## OBJECTIVES

To assess the state of the art and to make recommendations for future directions in the area of fish acoustics.

## APPROACH

A two-day review entitled "Fish Acoustics Science Review" was conducted involving scientists spanning the areas of acoustics, biology, and signal processing. The review began with a plenary meeting with each scientist presenting the state-of-the-art in their own area. Then the group broke up into several working groups in order to focus on pre-defined aspects of the field. At the end of the meeting, working group leaders presented their findings and plenary discussion and conclusions took place.

## WORK COMPLETED

1. Meeting time and location. The meeting was conducted on Nov. 1 and 2, 2007 in Plymouth, Massachusetts. Guest rooms, conference rooms, and a restaurant in a local hotel were used.

2. Participants. Twenty four scientists spanning acoustics, biology, and signal processing participated in the meeting. Also, there was at least one ONR program manager from each of the areas: Biology, Ocean Acoustics, and Undersea Signal Processing.

3. Scientific presentations. Subject material of the scientific presentations were organized according to the following areas:

a. Fish behavior
b. Large scale acoustic detection of fish (waveguide acoustics)
c. Small-to-medium scale imaging techniques
d. Swimbladder physiology and associated acoustic scattering modeling
e. Resonance classification of swimbladder-bearing fish
f. Signal processing

4. Working group meetings and presentations of their results. The topics of the meetings/presentations were organized according to the following areas:

a. Modeling/algorithm development
b. Advanced technology
c. Experiment/data analysis
d. DRI plans (three working groups total)

All 24 participants were initially involved with a-c above, then they were reorganized into three new working groups to formulate and present a plan (a "mock" presentation as if from the view of ONR) for a new DRI in fish acoustics.

## RESULTS

In order to allow ideas to be freely exchanged, it was agreed from the beginning that details of the discussions would not be distributed outside the group. However, it is safe to say in broad terms that there was a significant synergy in the two-day meeting both within and between disciplines. With the focus being on the intersection of the three areas—biology, acoustics, and signal processing—there was much "cross-over" of information from one discipline to another. New ideas and potential solutions to those ideas were identified. Also, new potential collaborations were also identified. It was clear from the conclusions that this field has made significant advances and is well positioned for new ones. This was especially apparent in the mock presentations of ONR DRI's in which a new five-year research program was proposed by each of the three working groups.

## IMPACT/APPLICATIONS

New directions for the field and potential solutions were identified as a result of this meeting. There is potential for these new directions to be realized through relationships and potential collaborations formed in this meeting.

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